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New Results from Spin Physics at RHIC

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The sign and magnitude of the gluon spin contribution (ΔG) to the spin of the proton has been a topic of intense interest and speculation since inclusive deep inelastic scattering experiments found the total quark spin contribution to be surprisingly small. Starting in 2002, the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Lab has provided access to longitudinally and transversely polarized proton collisions. Both PHENIX and STAR, the two largest collaborations at RHIC, have used this data to complete a series of inclusive hadron and jet double spin asymmetry (A_{LL}) measurements. The mid-rapidity π^0 and jet results, now included in a global analysis of existing world data, are shown to provide significant constraints on ΔG within their range of kinematic sensitivity. Recent inclusive pion and jet A_{LL} measurements will be presented. Plans to measure A_{LL} in correlation channels, for example di-jets and photon-jets, and parity violating asymmetries for identified $W^{+/-}$ in future longitudinal proton runs will be discussed. In addition to a successful ΔG program, the RHIC-Spin community is actively contributing to the new and rapidly expanding frontier within nucleon structure studies of transverse spin measurements. Quantum Chromodynamics predicts an extremely small ($\propto \frac{m_q}{\sqrt{s}}$) spin asymmetry for leading hadron production in the reaction $p^\uparrow p \rightarrow h + X$. Contrary to expectations, transverse single-spin asymmetries (SSA) of up to 30% were discovered in forward particle production more than three decades ago, and surprisingly, asymmetries of the same magnitude have been found to persist at current RHIC center-of-mass energies. The most recent forward π^0 and η SSA from STAR and PHENIX, as well as charged hadron measurements from the BRAHMS collaboration, will be discussed and compared with theoretical predictions.